Generalized gUidance, Navigation & Control Architecture for Reusable Development (GUARD): Performance Evaluation in Relevant Operating Environments, Phase II

Completed Technology Project (2015 - 2017)

Project Introduction

In Phase I of this project, SSCI carried out initial development of the Generalized Guidance, Navigation & Control Architecture for Reusable Development (GUARD). The resulting framework is applicable across different Autonomous Rendezvous and Docking (AR&D) domains, and enables further development and testing of reusable GN&C software for such applications. GUARD is based on the key functional requirements for GN&C software for AR&D, with special emphasis on the commonality across different domains of operation and unique implementation requirements for GN&C algorithms in such domains. Phase I accomplishments include: (i) Augmented the flight-test proven on-line trajectory optimization and control algorithm with a Fault Detection, Identification and Accommodation (FDIA) capability, (ii) Extended SSCI's Vision Based Navigation (VBN) algorithms, recently demonstrated for shipboard landing flight experiments, to achieve centimeter-level positioning accuracy for the AR&D implementations, and demonstrated its robustness to docking pattern variations; (iii) Carried out a detailed study of common GN&C functions for AR&D, and developed a conceptual solution for a user interface enabling agile reconfiguration of domain-specific information; and (iv) Carried out initial analysis of System-level Performance Metrics for AR&D missions to facilitate V&V of the overall integrated GN&C system. Phase II will demonstrate an enhanced prototype of the GUARD with integrated GNC/FDIA/VBN software that will make it reusable in three disparate AR&D system domains. Demonstrations will be in simulation and hardware tests as follows: orbital AR&D (in simulation), planetary rover docking with a habitat (evaluations at Olin College on R-Gator platform), and a quadrotor close-proximity operation mission (evaluations at UT Austin on quadrotor platform). Phase III will focus on commercialization of the GUARD software and its implementation to future NASA Space Exploration missions.

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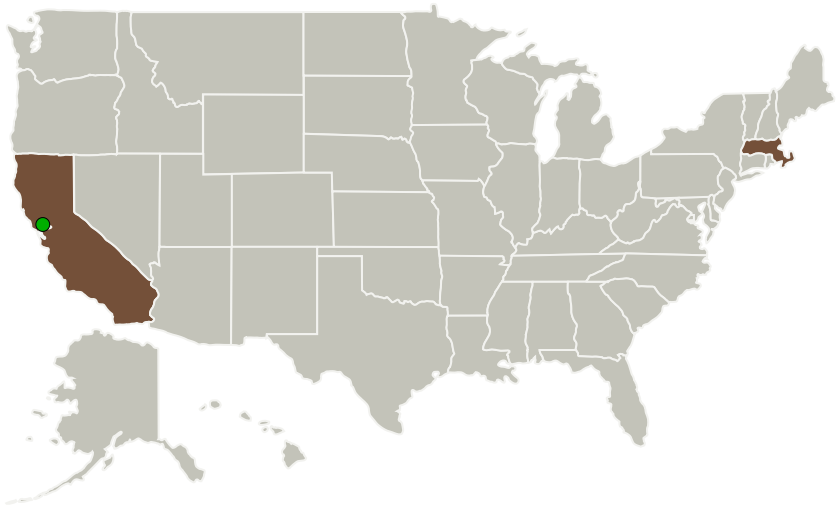
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Scientific Systems Company, Inc.	Lead Organization	Industry Small Disadvantaged Business (SDB)	Woburn, Massachusetts
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations	
California	Massachusetts

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Scientific Systems Company, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Joseph Jackson

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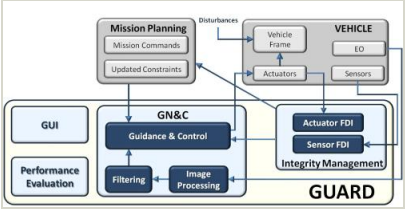
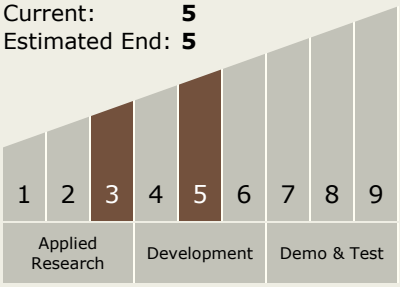
Images



Briefing Chart
Generalized gUidance, Navigation & Control Architecture for Reusable Development (GUARD): Performance Evaluation in Relevant Operating Environments Briefing Chart
(https://techport.nasa.gov/image/130449)

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



Technology Areas

Primary:

- TX17 Guidance, Navigation, and Control (GN&C)
  - TX17.5 GN&C Systems Engineering Technologies
    - TX17.5.1 GN&C System Architectures, Requirements and Specifications

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System